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AUTHOR Marinc, Jacqueline I.
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ABSTRACT

Children's spelling errors were examined to determine the relationships between linguistic cues used (phonetic, graphemic, and morphophonemic), grade level, reading proficiency, and spelling proficiency. The standardized reading and spelling test scores of 180 second, third, and fourth grade students were used to randomly select 22 good reader/good spellers, 22 good reader/poor spellers, and 22 poor reader/poor spellers. These subjects took a 45-item spelling test containing 15 chances at each of the three linguistic levels. A group of 62 fifth grade students also took a modified version of the experimental spelling test. Within each grade, morphophonemic structures yielded significantly more errors than graphemic structures. Graphemic structures yielded significantly more errors than phonetic structures for grades three and four, but not grade two. Across-grade comparisons were not significant, with only second grade means significantly greater than third/fourth grade means on phonetic and morphophonemic structures. Although phonetic, graphemic, and morphophonemic scores did not differ significantly across groups, the scores for the latter two linguistic levels approached significance and suggested replication in fifth grade subjects. These results indicated that linguistic cue systems comprised meaningful levels of processing for spellers, and that their use was relatively consistent. The findings also suggested that morphophonemic awareness may relate more to reading achievement than to spelling achievement. (RL)

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CHILDREN'S USE OF PHONETIC, GRAPHIC AND MORPHOPHONEMIC

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CUES IN A SPELLING TASK

Jacqueline L. Marino

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INTRODUCTION

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While there is no scarcity of research in spelling, only a small number of studies have focused on spelling as a cognitive process, sharing with oral language and reading a dependence upon an understanding of the pattern and structure of language. Fewer still have acknowledged the role of misspellings as clues to processing strategies, explored the developmental nature of those strategies, or speculated on possible relationships to reading.

The present research represents an extension of the existing literature, in that it examined children's spelling errors in the light of their developing knowledge about the English writing system, and attempted to relate that knowledge to both reading and spelling achievement. The study sought to answer three basic questions: What linguistic cue systems can be said to constitute meaningful levels of processing for spellers? What is the relationship between the use of those cue systems and grade in school? And how does the use of those cue systems vary with reading and spelling proficiency?

THE SPELLER AS STRATEGIST

This research was predicated upon the assumption that spelling errors may be considered "a device the learner uses in order to learn" (Stevens, 1969) and thus reflect one's developing efforts to understand the English writing system.

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This view of errors has characterized certain psycholinguistic theories of reading for the past two decades (e.g., Goodman, 1967; Weber, 1968), but only recently have researchers begun to regard misspellings as similar clues to a learner's search for strategy. A prime mover in the effort to recognize spelling errors as reflections of a psycholinguistic process is Read (1971, 1975), whose research suggests that the processes uncovered in even very early stages reveal some surprisingly regular judgments.

In an examination of the spontaneous spelling efforts of pre-schoolers, Read (1971) noted several emerging patterns: 1) the use of a single letter to represent the sound of a full letter name (ppl=people); 2) omission of vowels not pronounced as letter names (pkgr=picture); 3) omission of nasals before consonants (agre=angry); and 4) use of chr and jr in place of tr and dr (chrie=try, jragin=dragon). As children began to add non-name vowels to their spelling, they consistently chose representations in terms of phonetic properties. In other words, doctor was spelled diktr because the /o/ in doctor and the letter name i share the properties of voicing and backness; they are articulated at the same point in the mouth. In two related studies, this latter strategy was found to be salient for some children as late as the fourth grade (██████, 1977), and in spite of instruction in standard sound-symbol associations (Gerritz, 1975). While this evidence would seem to suggest a consistent, developmental pattern of spelling behavior in children, much of the related research is devoted to refining Read's categories of spelling among first and second graders (e.g., Fisher, 1973;

Beers, 1975). Conspicuously lacking is a description of the spelling cue systems utilized beyond the initial stages of phonetic categorization.

One advanced stage of understanding is described by Chomsky (1970), who suggests that both the skilled speller and the skilled reader learn to interpret the orthography at the morphophonemic level. That is, they must view the orthography not as a direct representation of the pronounced form of words, but as an abstract representation of an underlying semantic level of understanding. The learner who has access to this level knows that the a in infamous and the c in musician are predictable when viewed in the light of their relationship to fame and music, respectively.

Only one substantive study has explored the use of the morphophonemic level in spelling. In a study of good and poor readers in Grade 5, Barganz (1971) found that good readers were considerably better at selecting the correct spellings of derived forms (e.g., provincial) after hearing or seeing the root forms (e.g., province) than poor readers. That is, good readers were able to utilize a semantic level of knowledge to a greater degree than poor readers.

Complimenting this research is the finding by Zutell(1979) that the task of extending the spelling of the stressed vowel in a word like explain to the spelling of the schwa in explanation was the most difficult of five categories. While not specifically described as a task requiring morphophonemic information, Zutell's study would seem to define the morphophonemic level as an advanced level of word knowledge. Unfortunately, Zutell's failure to control for word length may have influenced his re-

sults, in that those items requiring morphophonemic understanding were also the longest.

If phonetic judgments based on place of articulation may be considered a primitive effort to understand the abstract nature of our writing system, and if morphophonemic understanding may be viewed as an advanced stage of understanding, is there an intermediate level of processing which spellers must tap in their search for orthographic knowledge?

Venezky (1967) suggests that there is. In his description of the structure of the English language, Venezky describes a graphemic level, which comprises those rules or generalizations inherent in the orthography, by which spoken forms of language are transcribed into written forms. The graphemic level includes knowledge of phoneme-grapheme correspondences, and knowledge of the constraints within which those correspondences operate.

That spellers' awareness of the graphemic level is developmental in nature is suggested by several research findings. Older children are more aware than younger children of sequential dependencies, or the probability of one letter following another in the English spelling system (Lefton, Spragins and Byrnes, 1976). They are better able to differentiate between probable and improbable letter combinations (Moretz, 1971). And, they are more likely to use the physical, as well as statistical, redundancies to identify words (Smith and Lott, 1977). While many of these studies involved tasks of recognition, rather than production, the results nevertheless add support to the notion that awareness of a graphemic level increases with maturation.

To summarize, the spelling process may be seen as incor-

porating linguistic knowledge at three levels: the phonetic level (i.e., cueing on formation of speech sounds); the graphemic level (i.e., cueing on writing system characteristics); and the morphophonemic level (i.e., cueing on an abstract, underlying lexical representation). This is not to suggest that these cue systems are tapped one at a time, but only that a given system may be more or less salient at a given stage of development. If we view these systems as levels of awareness, it seems reasonable to consider the most concrete system (phonetic) as the most accessible and the most abstract system (morphophonemic) as the least accessible. It would seem that the speller who has access to the constraints and rules associated with the orthography would be at a more advanced stage of development than the speller who is operating only with letter names and place of articulation, but not yet at the level of the child who has access to the underlying lexical level of word knowledge. Thus, an initial focus for this research was the changes revealed in children's spelling patterns across subsequent grade levels.

The Reading-Spelling Relationship

That reading and spelling are neither identical nor reciprocal processes has been substantively discussed (Gibson and Levin, 1975; Smith, 1972), though less substantively researched. The degree to which reading cue systems are also useful for spelling has been only superficially discussed (Cronnell, 1971), and research has been limited to a single study (Barganz, 1971). While it is likely that reading and spelling share components to a differing degree, it would seem to be equally likely that similar operations are at work in both processes. Psycholinguis-

tic theory views the effective reader as one who can extract the greatest amount of information from the text through strategic use of the syntactic, semantic, graphemic and phonemic cue systems (Goodman, 1967; Smith, 1972; Gibson and Levin, 1975). The degree to which the reader uses each of these cue systems depends in part upon his/her developing knowledge of the rules underlying our writing system. If, as has been suggested (Hanna, Hodges and Hanna, 1971), the ability to spell with proficiency is, likewise, a reflection of the linguistic knowledge one brings to the task, then misspelling should provide some important clues to the development of that knowledge. By comparing the use of phonetic, graphemic and morphophonemic cues for groups differing in spelling ability (good reader /good spellers and good reader/poor spellers) and groups differing in reading ability (good reader/poor spellers and poor reader/poor spellers), the results would suggest the relative importance of those cue systems in reading and spelling achievement. That is, if differences were found between GRGS and GRPS, then the cue system under consideration could be considered a relevant factor in spelling ability. If differences were found between GRPS and PRPS, then the linguistic level under consideration could be considered an important variable in reading ability. Thus, a second focus of the study was an examination of the linguistic level error patterns between groups defined by reading and spelling achievement.

In sum, it has been suggested that recent insights from the field of psycholinguistics offer some promising directions for spelling research. The view of oral reading errors as clues

to the processing behaviors of skilled readers suggests a similar perception of misspellings as sources of information about the development of spelling strategies in children. The description of reading and spelling as psycholinguistic phenomena prompts the speculation that similar cue systems are at work in both processes. Further, the not-infrequent disparity between reading and spelling achievement suggests that the phonetic, graphemic and morphophonemic levels of knowledge may have differing degrees of usefulness for the reader and the speller. Taken together, these observations encourage seeking empirical support for the 19th century insight that "words are not mere sounds, and in their orthography more is implied than in phonetics or phonography" (Brown, 1859).

METHOD

This section describes the selection of research subjects, the method of constructing and administering the evaluation instrument, procedures for scoring the responses, and a summary of the statistical treatment of the data.

Selection of Subjects

Subjects were drawn from a population of second, third and fourth graders (N=180) from a single elementary school located in a rural middle-class school district. Subjects were sampled without regard for sex or socioeconomic status, and I.Q. scores were unavailable; however, subjects were randomized for the study.

Three groups from each grade were selected on the basis of their Total Reading Scores on the SRA Achievement Series (SRA Form E, Level 1, Level 2, and Level SL for Grades two, three and Four, respectively) and their spelling scores on the Metropolitan Achievement Tests (MAT). Recent SRA scores were

available from student files. Because the SRA does not include a separate spelling subtest at the primary level, appropriate levels of the MAT were administered to all second, third, and fourth graders prior to the study, and the resulting scores used to group subjects by spelling ability. Groups were formed on the basis of the following criteria:

Good reader/good spellers (GRGS) were those children who scored at or above the 60th percentile on both tests. Good reader/poor spellers (GRPS) were those who scored at or above the 60th percentile on the reading test and at or below the 40th percentile on the spelling test. Poor reader/poor spellers (PRPS) were those who scored at or below the 40th percentile on both tests. In addition, all those designated as good readers were from one of the top two reading groups (of four) in their grade; all those designated as poor readers were from one of the bottom two reading groups in their grade. The above procedures resulted in the sampling distribution displayed in Table 1. A sought-for fourth category, poor reader/good spellers, yielded only four subjects, all of whose reading-spelling scores were at the boundaries of the criteria.

Insert Table 1 about here

Instrumentation

A forty-five item spelling test, constructed by the researcher, provided fifteen opportunities to make judg-

TABLE 1
FREQUENCY DISTRIBUTION OF ORIGINAL SAMPLE

	<u>GRGS</u>	<u>GRPS</u>	<u>PRPS</u>
Grade 2 (N = 52)	25	2	25
Grade 3 (N = 58)	36	3	19
Grade 4 (N = 70)	28	17	25
Total	89	22	69

ments reflecting knowledge of the three linguistic levels. Because frequency has been shown to correlate with spelling ease (Bloemer, 1959), all test items were controlled for frequency in the written language, with items constrained within a Standard Frequency Index of 39.0 to 49.0 according to The Word Frequency Book (Carroll, et al., 1971). The Standard Frequency Index (SFI) is an adjusted estimate of frequency of a word's occurrence in running text; e.g., an SFI of .40 means the word would occur once in a million words of connected discourse. Therefore, all test items were words of relatively low frequency. The constraints chosen for this study were arbitrarily selected as representing words difficult enough to elicit errors, but not so difficult as to preclude being placed in a meaningful context.

Because word length has been shown to correlate significantly with spelling difficulty (Bloemer, 1959), all test items contained three syllables. (Fewer syllables were judged inappropriate due to the difficulty of finding one- or two-syllable words which were representative of the morphophonemic level.) In addition, the location was, insofar as possible, contained in the same syllable. This latter control was provided to reduce the probability of serial order errors (Jensen, 1952). Items representative of each level were randomly distributed to control for order effects.

Appendix A lists the test items and their sentence contexts. Items representative of each linguistic level were selected as follows:

a) The Phonetic Level

The fifteen words which comprised this category provided the opportunity for making three of the five phonological judgments noted by Read (1971) and others. Those selected, the a for /ě/ substitution (e.g., detective), omission of pre-consonantal nasals (e.g., inventor), and substitution by affrication (e.g., retreated) were shown to be the best predictors of total performance in a pilot study of children's spelling judgments based on point of articulation (Marino, 1977).

b) The Graphemic Level

The fifteen items comprising this category provided five opportunities each for utilizing three types of graphemic information: markers, alternations and orthographic rules.

The primary function of markers is to indicate the function of other graphemes and to preserve spelling patterns. The grapheme markers examined here were the final silent-e marking a preceding vowel (e.g., navigate), the k preserving a stop (e.g., picnicking), the e preserving a fricative (e.g., changeable), and the e marking a final u (e.g., residue).

Position often determines the particular grapheme to use in a particular instance; for example, ck never begins a word but frequently appears in final position. Accordingly, the graphemic alternations represented in the present study were the complementary distributions of u (which follows g, j, n, p, c, and s) and w (which follows all other letters), as in distinguished vs. awkwardly; and the improbable occurrences of q without a subsequent u (e.g., requirement) and final y without an e (e.g., unlovely).

The orthographic rules which constituted the third segment

of the graphemic category were the doubling rule and the final silent-e rule for adding suffixes. These generalizations are among those usually conceded to be the most utilitarian (Wheat, 1932; Walmsley, 1973).

c) The Morphophonemic Level

The fifteen items comprising this category provided the opportunity for recognizing the semantic relationship between root words and their derived forms. Many of the stimuli were those used in Barganz' (1971) study of the morphophonemic performance of good and poor readers. Test items represented the t-/ch/ alternation (e.g., suggestion), the t-/sh/ alternation (e.g., promotion), and the k-/sh/ alternation (e.g., musician). For all categories, selection was limited to structures for which target judgments were likely to constitute a high percentage of the errors.

Procedures

Because a pilot study (Marino, 1977) revealed some anomalous results caused by variant pronunciations by classroom teachers, test items were administered by the experimenter, following random assignment to one of two lists. The test was given to children in their reading groups in two separate sittings (to reduce fatigue), distributed within the space of a week. Students were told that many of the words would be unfamiliar and that they were not expected to get them all correct. The experimenter explained that the purpose of the task was to "find out which part of these words is the hardest part for children to spell."

The experimenter pronounced the word, read two sentences containing the word, and pronounced the word again. The first sentence was a defining sentence; the second used the word in an appropriate context. Subjects were given fifteen seconds in which to write their responses.

Scoring Procedures

Responses were written by the students on prepared answer sheets and subsequently assigned one of five numerical codes (See Appendix B for description and examples). The principal analysis was confined to examination of the target errors, but the more elaborate scoring procedure was helpful in determining the general pattern of responses.

Target errors were predicted misspellings of those linguistic structures under consideration. At the phonetic level, target errors were those spellings based on point of articulation (e.g., retreated - rechreated). At the graphemic level, target errors were those which reflected lack of knowledge of graphemic markers, orthographic rules, or consonant alternations (e.g., distinguished - distingwished). At the morphophonemic level, target errors reflected unawareness of semantic relationships (e.g., inertia - inersha). Criteria for all target errors were determined prior to the initiation of the study and are included with the test items in Appendix A.

As there were fifteen opportunities for making incorrect target judgments at each linguistic level, mean scores per level could range from 0 to 15, with high scores reflec-

ting less knowledge of the linguistic structures under consideration than low scores.

Design and Analysis

The present study examined the relationships between grade, group defined by reading and spelling ability, and children's misspellings as viewed at three linguistic levels. The result was a 3x3x3 (grade by group by linguistic level) factorial design with repeated measures on the dimension of linguistic level. Because sampling yielded markedly unequal N's, factors were collapsed on appropriate dimensions, resulting in two separate 3x3 repeated measures analyses of variance. That is, of the 180 children selected for the study, 52 from each grade were randomly selected for the grade by linguistic level analysis, and 22 from each reading/spelling group (GRGS, GRPS, PRPS) were randomly selected for the group by linguistic level analysis. The above procedures resulted in the distribution displayed in Table 2.

Insert Table 2 about here

Hypotheses

The following specific hypotheses were tested, using the two repeated measures analyses of variance:

- 1) The mean number of target errors would be smaller for fourth graders than for third graders, for third graders than for second graders, for GRGS than for GRPS, and for GRPS than for PRPS. If significant differences were found, these results would support the prediction that children increasingly make use of their knowledge of linguistic structures in their spelling, in relation to their grade, reading ability and measured spelling

TABLE 2
DISTRIBUTION AND MEAN READING¹ AND SPELLING² PERCENTILES
FOR STATISTICAL SAMPLE

<u>Grade</u>	<u>Rdg. %ile</u>	<u>Sp. %ile</u>
2 (N = 52)	Mean 53.29 S.D. 31.86	49.87 30.61
3 (N = 52)	Mean 65.00 S.D. 29.90	59.34 27.48
4 (N = 52)	Mean 64.39 S.D. 30.93	44.70 29.76
<u>Group</u>		
GRGS (N = 22)	Mean 85.93 S.D. 11.96	78.92 12.07
Gr. 2 = 7		
Gr. 3 = 7		
Gr. 4 = 8		
GRPS (N = 22)	Mean 76.55 S.D. 11.49	27.50 10.06
Gr. 2 = 2		
Gr. 3 = 3		
Gr. 4 = 17		
PRPS (N = 22)	Mean 24.87 S.D. 10.48	22.25 8.84
Gr. 2 = 7		
Gr. 3 = 7		
Gr. 4 = 8		

¹From SRA Achievement Series Total Reading Scores

²From Metropolitan Achievement Test Spelling Subtest Scores

achievement. This hypothesis was tested by analyzing the main effects of grade and group.

2) The mean number of target errors would be greater at the morphophonemic level than at the graphemic level, and greater at the graphemic level than at the phonetic level. If differences were found, these results would demonstrate the reality of those cue systems for spelling, and would support the prediction that children's acquisition of linguistic knowledge in spelling is sequential. This hypothesis was tested by analyzing the main effects of linguistic level.

3) Within each grade level, morphophonemic structures would elicit the highest number of target errors, graphemic structures an intermediate number of target errors, and phonetic structures the fewest target errors. At the same time, the mean number of target errors at each linguistic level would decrease as grade level increased. If differences were found, these results would support the prediction that spellings of children in higher grades reflect a more sophisticated linguistic knowledge than do spellings of children in lower grades. This hypothesis was tested by analyzing the interaction of grade by linguistic level.

4) The pattern of linguistic level errors between groups differing markedly in spelling ability (GRGS, GRPS) would be different from the pattern of linguistic level errors between groups differing markedly in reading ability (GRPS, PRPS). No a priori prediction was made, but if significant differences were found, those results would help to define the role of phonetic, graphemic and morphophonemic understanding in reading and spelling achievement. This hypothesis was tested by analysis of the group

by linguistic level interaction.

Experiment 2

To obtain more information on a factor which seemed to increase with grade level (i.e., the good reader/poor speller distinction), a second study was undertaken, using a sample of fifth graders from the same rural elementary school which provided the first sample. Twenty items from the original 45-item spelling test were selected as stimuli for the second study. Items representative of phonetic structures were omitted because those kinds of errors appeared infrequently in the fourth grade. In addition, five graphemic and five morphophonemic stimuli which had generated more "other judgments" than predicted errors were also omitted. The test items used in the second study are indicated in Appendix A by an asterisk.

The new test was administered by the experimenter to 62 fifth graders in a single sitting. Subjects were subsequently assigned to the GRGS, GRPS, or PRPS group according to their reading and spelling scores on the SRA Achievement Series, using the same criteria as were used for the principal study. Such assignment yielded only ten GRPS. Ten GRGS and ten PRPS were selected randomly to equalize cell N's, and the resulting 3x2 (group by linguistic level) design was analyzed by a repeated measures ANOVA to test for the interaction of group by linguistic level.

For all hypotheses, where overall F-statistics were significant, appropriate post hoc procedures were used to reveal sources of any significant effects. In addition to the above analyses, some informal observations were made regarding the general pattern of responses.

RESULTS

Of the four hypotheses underlying the present research, one, Hypothesis 2, was upheld in its entirety; namely, that the mean number of target errors would increase with the sophistication of the linguistic level under consideration ($F=5.59$; $df=2$, $p < .001$). Predictions regarding main effects for grades were upheld for Grades 2 ($\bar{x}=5.13$) and 3 ($\bar{x}=3.84$) and Grades 2 and 4 ($\bar{x}=3.58$), but not for Grades 3 and 4. Predictions regarding the linguistic level interaction were partially upheld; within each grade, morphophonemic structures yielded significantly more errors ($p < .05$) than graphemic structures. Graphemic structures yielded significantly more errors than phonetic structures in Grades 3 and 4, but not in Grade 2, where differences between graphemic and phonetic scores were non-significant. Across-grade comparisons were largely non-significant, with only Grade 2 means significantly greater than Grade 3 or Grade 4 means on phonetic and morphophonemic structures.

While neither phonetic, graphemic nor morphophonemic scores differed significantly across groups, the scores of the latter two linguistic levels approached significance and suggested replication in Grade 5. Findings of the follow-up study duplicated previous (non-significant) findings for the graphemic level, but produced significant differences ($F=10.45$; $df=2$, $p < .001$) between scores at the morphophonemic level for the two groups differing in reading ability (GRPS, PRPS). Results of all post hoc tests are displayed in Tables 3-8.

Insert Tables 3-8 about here

TABLE 3

SIGNIFICANTLY DIFFERENT MEAN TARGET ERROR SCORES FOR GRADES¹

<u>GRADE</u>	<u>MEAN</u>
4 (N = 52)	3.58]
3 (N = 52)	3.84]]
2 (N = 52)	5.13]]]

¹The first mean in each bracket is significantly different ($p < .05$) from all means outside of that bracket, but not from other means contained in that bracket, using the least significant difference procedure.

TABLE 4
SIGNIFICANTLY DIFFERENT MEAN TARGET ERROR SCORES FOR
LINGUISTIC LEVEL¹

<u>LINGUISTIC LEVEL</u>	<u>MEAN</u>
Phonetic (N = 15)	1.87]
Graphemic (N = 15)	3.72]
Morphophonemic (N = 15)	6.97]

¹The first mean in each bracket is significantly different ($p < .05$) from all means outside of that bracket, but not from other means contained in that bracket, using the least significant difference procedure.

TABLE 5
SIGNIFICANTLY DIFFERENT MEAN TARGET ERROR SCORES
FOR GRADE BY LINGUISTIC LEVEL INTERACTION¹

<u>GRADE</u>	<u>LINGUISTIC LEVEL</u>	<u>MEAN</u>
4 (N = 52)	phonetic (N = 15)	1.06
3 (N = 52)	phonetic	1.37
2 (N = 52)	phonetic	3.17
2	graphemic (N = 15)	3.52
3	graphemic	3.75
4	graphemic	3.88
4	morphophonemic (N = 15)	5.81
3	morphophonemic	6.40
2	morphophonemic	8.69

¹The first mean in each bracket is significantly different ($p < .05$) from all means outside of that bracket, but not from other means contained in that bracket, using Tukey's A procedure.

TABLE 6
SIGNIFICANTLY DIFFERENT MEAN TARGET ERROR SCORES FOR GROUP
BY LINGUISTIC LEVEL INTERACTION¹

<u>GROUP</u>		<u>LINGUISTIC LEVEL</u>	<u>MEAN</u>
GRGS	(N = 22)	phonetic (N = 15)	1.14
GRPS	(N = 22)	phonetic	2.14
PRPS	(N = 22)	phonetic	2.45
PRPS		graphemic (N = 15)	2.91
GRGS		graphemic	4.32
GRPS		graphemic	4.41
GRGS		morphophonemic (N = 15)	5.45
GRPS		morphophonemic	6.55
PRPS		morphophonemic	7.36

¹The first mean in each bracket is significantly different ($p < .05$) from all means outside of that bracket, but not from other means contained in that bracket, using Tukey's A procedure.

TABLE 7
SIGNIFICANTLY DIFFERENT MEAN TARGET ERROR SCORES
FOR GRADE FIVE GROUPS¹

<u>GROUP</u>		<u>MEAN</u>
GRGS	(N = 10)	2.95
GRPS	(N = 10)	3.45
PRPS	(N = 10)	4.45

¹The first mean in each bracket is significantly different ($p < .05$) from all means outside of that bracket, but not from other means contained in that bracket, using the least significant difference procedure.

TABLE 8

SIGNIFICANTLY DIFFERENT MEAN TARGET ERROR SCORES FOR
GRADE FIVE GROUP BY LINGUISTIC LEVEL INTERACTION¹

<u>GROUP</u>	<u>LINGUISTIC LEVEL</u>	<u>MEAN</u>
GRGS (N = 10)	morphophonemic (N = 10)	1.50
GRPS (N = 10)	morphophonemic	2.60
PRPS (N = 10)	graphemic (N = 10)	3.60
GRPS	graphemic	4.30
GRGS	graphemic	4.40
PRPS	morphophonemic	5.30

¹The first mean in each bracket is significantly different ($p < .05$) from all means outside of that bracket, but not from other means contained in that bracket, using Tukey's A procedure.

DISCUSSION

Because this study yielded significant differences between linguistic level scores, these results add support to the assumptions that the phonetic, graphemic and morphophonemic cue systems do comprise meaningful levels of processing for spellers, and that their use is relatively consistent. Further evidence of this consistency is offered by the observation that where test items failed to elicit the predicted error, in several cases the actual error was simply an orthographically acceptable substitute. For example, the word residue proved to be an inappropriate example of a graphemic marker because the most frequent misspelling was residew, rather than the predicted residu. In other words, spellers were calling upon their knowledge of English orthography and tapping a different facet of the same cue system.

Additional support for the reality of cue systems is offered by the finding that the analysis of correct spellings duplicated the grade, group and linguistic level effects revealed in the target error analysis. These parallel results lend credence to the view that misspellings not only provide insight into processing strategies, but also yield information which is congruent with traditional analyses. Where the latter report successful attainment of knowledge, error analysis focuses on the speller in a stage of transition. Results of this research suggest the concept of cue systems as they relate to those transitional stages is a fruitful one.

It is apparent that children's use of linguistic cue systems is not strictly a function of grade level. The finding that second graders made significantly more target errors than third or fourth graders was consistent with the original hypothesis, but

the fact that scores of third and fourth graders were not significantly different was contrary to expectation. These results may reflect the unequal distribution of poor spellers across grades (See Table 2). Since GRPS were relatively rare in Grade 2 ($N=2$) and in Grade 3 ($N=3$), poor spellers in those grades consisted of the 7 PRPS subjects plus the two or three from the GRPS group. But in the fourth grade, poor spellers included the 8 subjects in the PRPS group, plus 17 GRPS subjects. Therefore, it may be that the additional poor spellers in Grade 4 served to lower the class mean to a level approaching that of Grade 3.

As might be expected, use of phonetic representations beyond Grade 2 was minimal. Yet, the finding that some children, however few, revert to a primitive strategy when confronted with unfamiliar words suggests that spelling is not unlike other cognitive processes, in that it involves a developmental progression of stages, marked by frequent regressions on the path toward competence. This contention is supported by the observation that, where children did make phonetic judgments, they did so consistently. It is interesting that, while children in lower reading groups appeared to sub-vocalize extensively during testing, such group effects were not revealed by the statistical analysis, suggesting that use of the phonetic level is not limited to those who sub-vocalize. It may be that the vocalizations reflected the difficulty of the task, in that the subjects were attempting to find a match between the test item and a word in their oral vocabulary.

Neither grade nor group effects were found for the graphemic^{level} a result which was initially puzzling. However, it may be of some import that of the three linguistic levels, the graphemic cate-

gory was the least narrowly defined. Phonetic structures were selected as representing three variations on a single type of judgment, and had already been shown to be good predictors of performance on a related task (Marino, 1977). Morphophonemic structures represented three kinds of derivational alternations, all of which differed by only one or two letters. But graphemic structures represented more diverse kinds of knowledge. It may be that markers, graphemic alternations and orthographic rules actually represent varying degrees of abstractness, even though all appear to represent surface-level characteristics. In fact, a case could be made for the notion that graphemic markers, such as the e preserving a fricative (e.g., changeeable) is close to a phonetic understanding, while the complimentary distribution of u and w, as in distinguished vs. awkwardly, represents an underlying level of awareness not unlike the morphophonemic level.¹ It is possible that the combined effects of such differing kinds of understanding may help to account for the lack of differential effects for either grades or groups.

The issue of the reading/spelling relationship is a complex one, and answers are elusive, for groups which differ in only one or the other ability are not easily found. Of over 200 children tested in Grades 2 through 5, only 32 good reader/poor spellers were found (according to the criteria used). The fact that 27 of these appeared in Grades 4 (N=17) and 5 (N=10) arouses some interesting speculations.

¹ This speculation was, in fact, supported by Marino (1979), who found that good and poor spellers did diverge on their ability to spell words requiring graphemic alternations.

One possibility for this apparent inequity is that the beginning stages of reading and spelling involve identical processes, so that reading and spelling ability would automatically be commensurate. This seems unlikely in the light of what is known about the two processes; e.g., symbol-sound and sound-symbol correspondences are not ^{necessarily} reversable in English, and first graders tend to make spelling judgments based on phonological perceptions even after exposure to standard symbol-sound correspondences.

A second possibility is that reading and spelling are merely treated identically. Where instruction and evaluation of both reading and spelling are restricted to knowledge of symbol-sound, and sound-symbol associations, as in some intensive phonics programs, the differences between the two processes are minimized. Early reading does not typically stress morphophonemic understanding, and beginning spelling words, at least those employed in most published programs, do not heavily rely on knowledge of orthographic constraints; thus, it is not until the later grades that access to those levels is required.

The differential effects of reading and spelling ability in higher grades are more marked, suggesting that the kinds of orthographic knowledge required for beginning spelling and the kinds of orthographic knowledge necessary to the skilled spellers are not equivalent. In the beginning stages, the spelling task focuses primarily on words which are phonemically regular. As the orthography becomes more morphophonemically-based, it may aid the reader in his or her search for meaning, but

imposes added burdens on the speller. Thus, knowledge of the orthography makes fewer demands on the beginning speller, whereas the older speller, to spell with proficiency, must be cognizant of the irregularities in the language and the abstract nature of the writing system.

The findings suggested by the principal investigation and supported by the follow-up study seem to suggest that morphophonemic awareness may have a greater relationship to reading achievement than to spelling achievement. These conclusions are tentative, but at least support previous findings by Barganz (1971) and are consistent with Chomsky's (1970) view of reading as a meaning-getting process. The present research also suggests that beginning spellers' use of morphophonemic information follows a developmental progression, and is, in most cases, less accessible to children than phonetic or graphemic information. The finding that spelling achievement is not enhanced by awareness of underlying meaning relationships is contrary to many accepted instructional practices. While the teaching of such spelling patterns as homonyms is obviously dependent upon meaning relationships, it may be that, for other words, the current practice of writing words in sentences is less helpful than listing other words containing the same letter patterns.

Taken together, the results of this research support an instructional curriculum which places misspellings within a developmental framework, each stage of which reveals something about the processing strategies of the speller. Furthermore, if we are to take seriously children's efforts to discover the rules and constraints associated with the orthography, then it would

seem essential to emphasize the nature of that orthography in spelling instruction. Spelling taught from within the context of our writing system, rather than from within the context of vocabulary development, might well foster a greater awareness of recurring letter patterns, probable letter combinations and the effects of position and stress, as well as a broader grasp of our linguistic heritage.

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APPENDIX A

TEST ITEMS, TARGET ERRORS AND SENTENCE CONTEXTS

Phonetic Level

1. repentance - omission of n
Repentance is the act of feeling sorry for something.
Her apology showed repentance at stealing the candy.
2. prevented - omission of n
Prevented means having kept something from happening.
The baby sitter prevented the child from falling down-
stairs.
3. inventor - omission of n
An inventor is a person who creates something.
Eli Whitney was the inventor of the cotton gin.
4. demanding - omission of n
Demanding means asking insistently.
The hungry boy was demanding a cookie.
5. resemble - omission of m
To resemble means to look like something or someone
else.
Do you resemble anyone in your family?
6. subtracting - ch
Subtracting means taking away.
He was subtracting 2 from 5 and got 3.
7. retreated - ch
Retreated means having backed away from.
The frightened child retreated from the angry dog.
8. attractive - ch
Attractive means nice-looking.
You have a very attractive home.
9. contribute - ch
To contribute means to give to a cause or a group.
Did you contribute to UNICEF?
10. controlling - ch
If you are controlling something, you have power over
it.
He had an accident because he wasn't controlling the
car properly.
11. detective - a
A detective is a person who looks for clues to a crime.
Sherlock Hemlock is a detective on Sesame Street.

12. professor - a
A professor is a teacher in a college.
The professor always gave his students long assignments.
13. athletic - a
Athletic means strong and active.
Someone who is athletic is usually good at sports.
14. respectful - a
Respectful means polite.
The children were respectful when the principal walked into the room.
15. semester - a
A semester is a marking period.
Did you get all A's this semester?

Graphemic Level

- *16. omitting - omission of t
Omitting means leaving out something.
I hope you'll finish this exercise without omitting any words.
- *17. occurrence - omission of r
An occurrence is an event.
Snow in July is an unusual occurrence.
- *18. embedded - omission of d
Embedded means set into something.
There were raisins embedded in all the cookies.
19. relating - addition of e before ing
Relating sometimes means telling.
The librarian was relating a funny story.
20. providing - addition of e before ing
Providing means supplying.
The boys had fun providing refreshments for the party.
- *21. changeable - omission of e
If something is changeable, it varies.
When it is sunny one day and rainy the next, we say the weather is changeable.
- *22. picnicking - omission of k
When you are picnicking, you are eating outdoors.
The children were picnicking under the maple tree.
23. residue - omission of e
Residue is something that is left over.
When you make coffee in a coffee pot, coffee grounds are the residue.

- *24. panicky - omission of k
Panicky means frightened.
Nancy Drew was panicky when she found a snake in her suitcase.
- *25. navigate - omission of n
Navigate means to steer a boat.
If you don't know how to navigate, you may get stuck in the mud.
- *26. unlovely - omission of n
Unlovely means disagreeable or unpleasant.
A skunk has an unlovely odor.
- 27. headquarters - omission of u or substitution of w
Headquarters are the central offices.
The police headquarters are sometimes in the town hall.
- 28. awkwardly - u
Awkwardly means in a clumsy manner.
The clown walked awkwardly around the ring.
- *29. distinguished - w
Distinguished sometimes means famous.
President Carter is a distinguished person.
- *30. requirement - omission of u or substitution of w
A requirement is something that is needed.
Snow is a requirement if you are going skiing.

Morphophonemic Level

- 31. inertia - sh or ch
Inertia is the tendency of moving objects to keep on moving.
Inertia kept the car rolling after the engine stopped.
- *32. induction - sh or ch
Induction sometimes means swearing into office.
The President's induction is called an inauguration.
- *33. adoption - sh or ch
Adoption means bringing up another child as one's own.
Many Vietnamese children have come to the U.S. for adoption.
- *34. magician - sh or ch
A magician is a person who does unusual tricks.
The magician pulled a rabbit out of his hat.
- *35. musician - sh or ch
A musician is one who is skilled at playing an instrument.
The musician tuned his guitar.

36. suggestion - sh or ch
A suggestion is an idea.
Do you have a suggestion for a good book to read?
37. productions - sh or ch
Some productions are plays.
All the productions of Cinderella use a glass slipper.
- *38. physician - sh or ch
A physician is a doctor.
Dr. Lohnes is our school physician.
- *39. provincial - sh or ch
Provincial means very plain and primitive.
Provincial homes had no indoor plumbing.
- *40. abstraction - sh or ch
An abstraction is something you can't see, like an
idea.
Freedom is an abstraction.
- *41. promotion - sh or ch
Promotion means movement from one grade to the next.
If you get a promotion, you will be in the _____ grade.
- *42. distinction - sh or ch
A distinction is an honor.
She had the distinction of being the only child with
perfect attendance.
43. dictation - sh or ch
Dictation means speaking so that someone else can
write it down.
When you take dictation, you should spell everything
correctly.
- *44. rejection - sh or ch
Rejection sometimes means being left out.
The new boy was afraid of rejection by his classmates.
45. injection - sh or ch
An injection is a shot.
She tried not to cry when the doctor gave her an
injection.

APPENDIX B

DESCRIPTION OF CODES USED IN SCORING STUDENT RESPONSES

<u>Code</u>	<u>Explanation</u>	<u>Example</u>
1	Correct spelling for entire word	retreated
2	Target error	rechreted
3	Other judgment (unpredicted error on target structure)	reteated
4	Correct target structure but error elsewhere in word	retreatid
5	No response, or partial spelling which did not include target structure	r...., or reated

REFERENCES

- Barganz, R.A. The morphophonemic performance of good and poor readers. Wisconsin University, Madison, Wisc. Research and Development Center for Cognitive Learning. November, 1971. (ERIC Document Reproduction Service No. ED 070 064)
- Beers, J.W. First and second grade children's developing orthographic concepts of tense and lax vowels. Unpublished dissertation, University of Virginia, 1974. (University Microfilms, 1975, No. 75-4694)
- Bloomer, R.H. Stimulus properties of words: variables related to spelling difficulty. Unpublished dissertation, University of Southern California, Los Angeles, 1959.
- Brown, G.G. The grammar of English grammars (4th ed.). New York, 1859. Quoted in R. Venezky, The Structure of English Orthography. The Hague: Mouton, 1970.
- Carroll, J.B., Davies, P., and Richman, B. American Heritage word frequency book. Boston: Houghton Mifflin, 1971.
- Chomsky, C. Reading, writing and phonology. Harvard Educational Review, May 1970, 40, 287-309.
- Cronnell, B. Spelling to sound correspondences for reading vs. sound to spelling correspondences for writing. SWRL, Inglewood, California, June 1971, 12-21. (ERIC Document Reproduction Service No. ED 057 024)
- Fisher, E.M. A linguistic investigation of first grade children's spelling errors as they occur in their written compositions. Unpublished dissertation, University of Virginia, 1973. (ERIC Document Reproduction Service No. ED 086 974)
- Gerritz, K.E. First graders' spelling of vowels: an exploratory study. Unpublished dissertation, Harvard University, 1975. (ERIC Document Reproduction Service No. ED 116 199)
- Gibson, E. and Levin, H. The psychology of reading. Cambridge, Mass.: MIT Press, 1975.
- Goodman, K.S. Reading: a psycholinguistic guessing game. Journal of the Reading Specialist, May 1967, 6, 126-35.
- Hanna, P.R., Hodges, R.E., and Hanna, J.S. Spelling: structure and strategies. Boston, Mass.: Houghton Mifflin, 1971.

- Jensen, A.R. Spelling errors and the serial-position effect. Journal of Educational Psychology, 1962, 53, 105-9.
- Lefton, L.A., Spragins, A.B. and Byrnes, J. English orthography: relation to reading experience. Bulletin of the Psychonomic Society, 1976, 2, 281-282.
- Phonetic judgments of children in first through fourth grades. Unpublished paper, 1977.
- Children's use of graphemic cues in a spelling task. Unpublished paper, 1979.
- Moretz, S.A. Relationship of spelling, reading and knowledge of graphemic options. Unpublished dissertation, Florida State University, 1971. (ERIC Document Reproduction Service No. ED 067 666)
- Read, C. Pre-school children's knowledge of English phonology. Harvard Educational Review, February 1971, 41, 1-34.
- Read, C. Children's categorizations of speech sounds in English. Urbana, Illinois: National Council of Teachers of English, 1975.
- Smith, F. Phonology and orthography: reading and writing. Elementary English, 1972, 49, 1075-88.
- Smith, F. and Lott, D. Knowledge of intra-word redundancy by beginning readers. Psychonomic Science, 1970, 19, 343-44.
- Stevens, P. Two ways of looking at error analysis. Pre-publication draft, November 1969. (ERIC Document Reproduction Service No. ED 037 714)
- Venezky, R.F. English orthography: its graphical structure and its relation to sound. Reading Research Quarterly, Spring 1967, 2, 75-106.
- Walmsley, S.A. Developing a criterion-referenced spelling test for 7th and 8th graders. Unpublished paper, Harvard University, 1973.
- Weber, R. The study of oral reading errors: a review of the literature. Reading Research Quarterly, Fall 1968, 4, 96-119.
- Wheat, L.B. Four spelling rules. Elementary School Journal, May 1932, 32, 697-706.
- Zutell, J. Spelling strategies of primary school children and their relationship to Piaget's concept of decentration. Research in the Teaching of English, 13(1), February 1979, 69-80.